Large-scale fire test of unprotected cellular beam acting in membrane action

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Introduction

- This paper describes a full scale fire test performed recently at the University of Ulster on a composite floor for analysing the possibility of tensile membrane action to develop when the unprotected steel beams in the central part of the floor are made of cellular beams.

- This test was realised in the scope of the project FICEB+ (Fire Resistance of Long Span Cellular Beams Made of Rolled Profiles) ; a project funded by the European Research Fund for Coal and Steel.

FICEB+ - Partnership

ArcelorMittal

ArcelorMittal

Westok

cticm

SCI

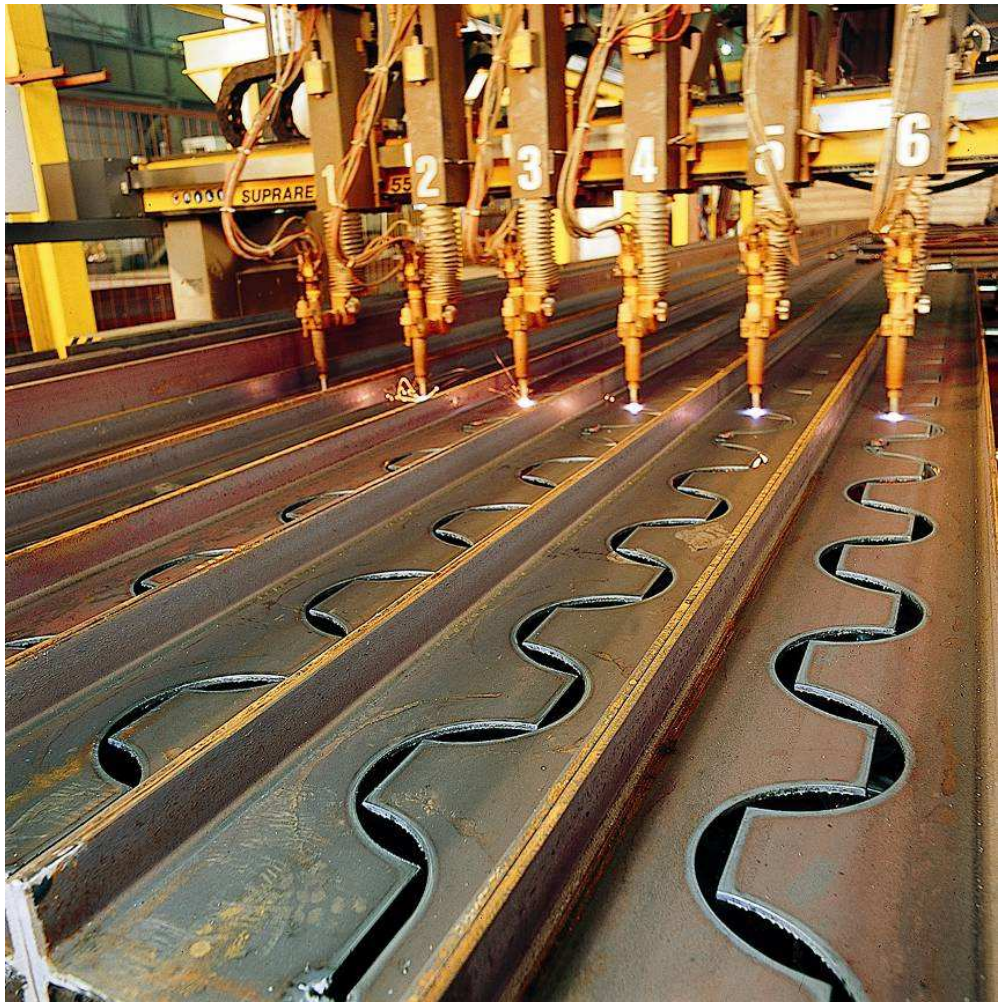
University of ULSTER

Université de Liège

Introduction

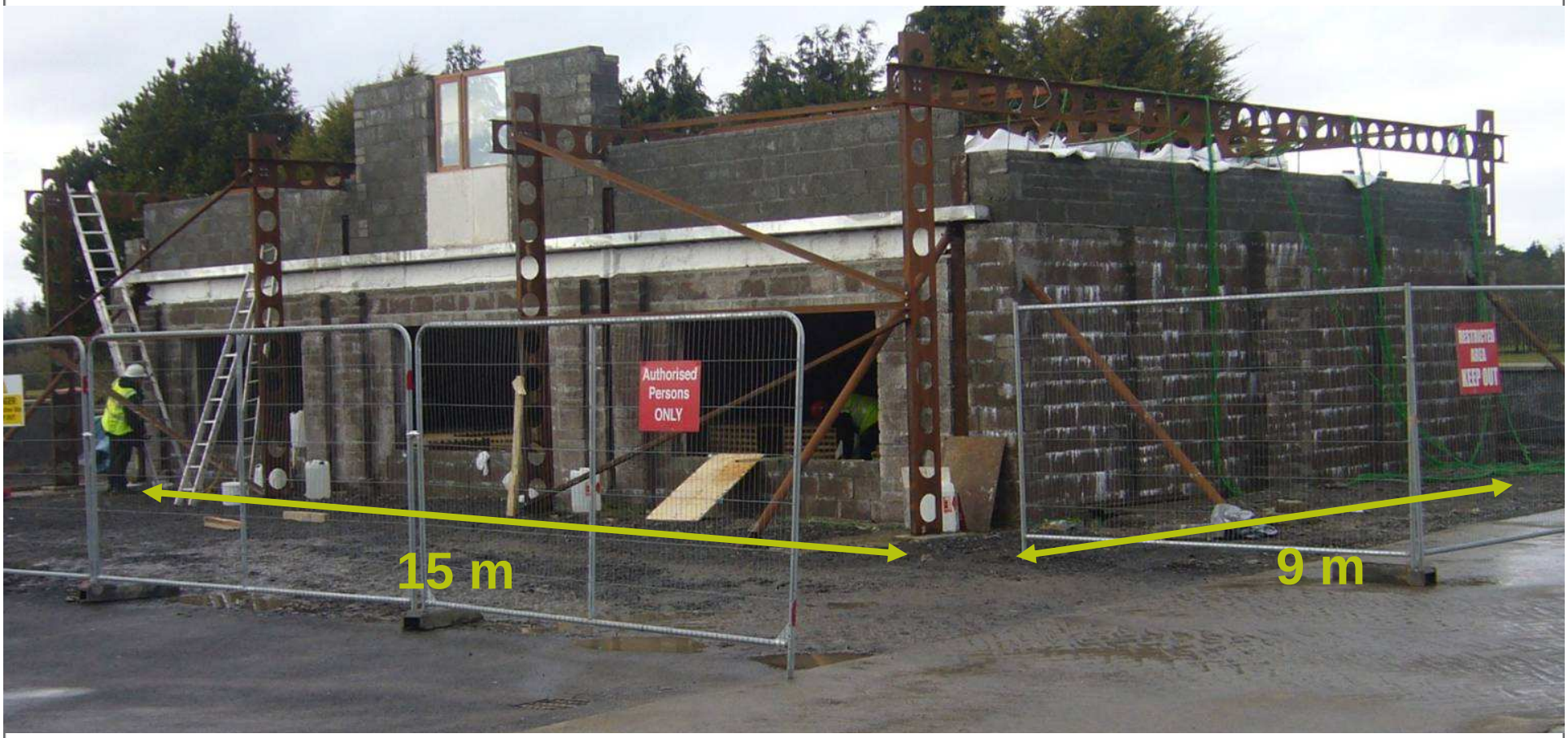
Cellular Beam fabrication

ArcelorMittal



25th February 2010

Global dimensions of the compartment

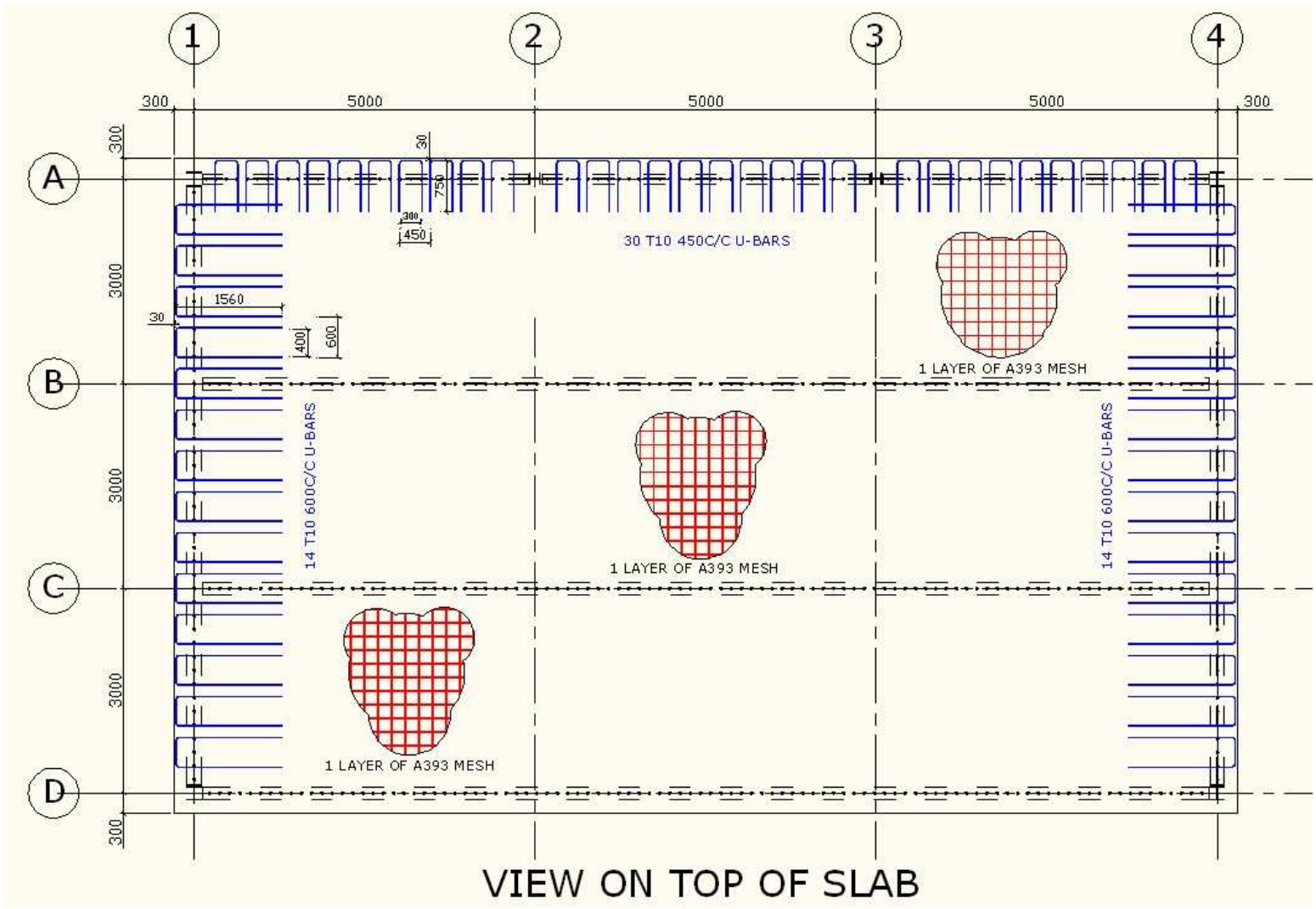


Bearing structure

Fire protection

Steel sheeting and reinforcement

Reinforcement

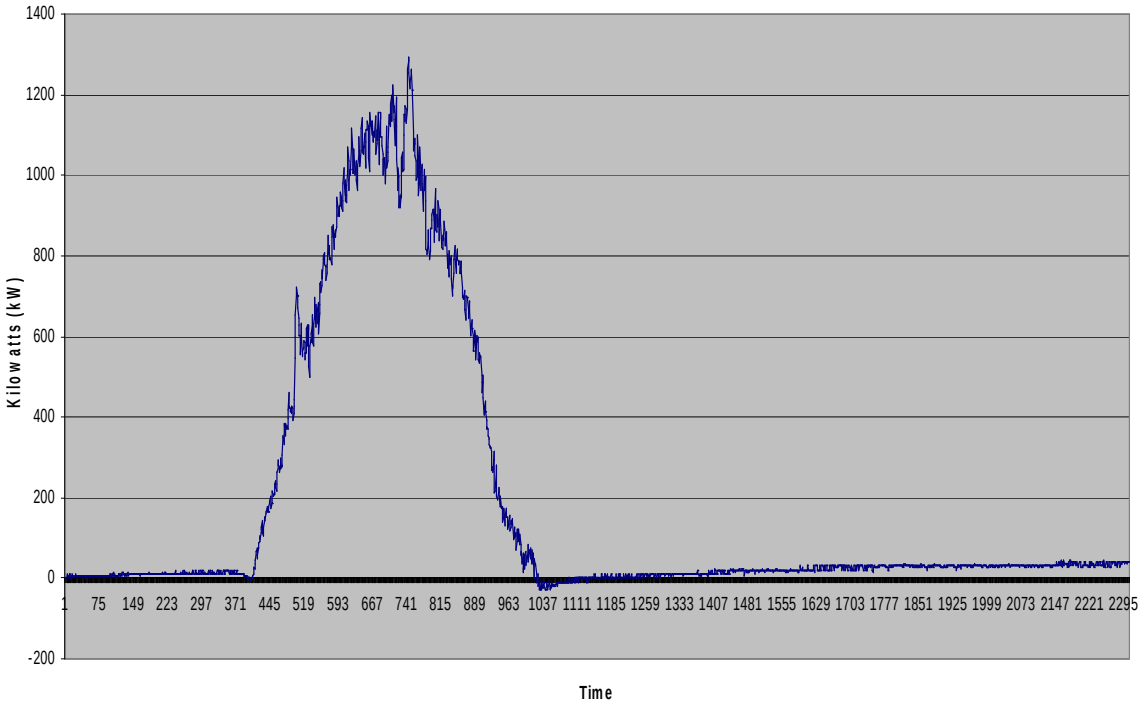


Design Loads

Description	Characteristics kN/m²	Load Factor	Design Load kN/m²
Partition	1.0	1.0	1.0
Services & Finishes	0.5	1.0	0.5
Live Load	3.5	0.5	1.75
		Total	3.25

The loads used within the structure are the same as those which are commonly used in the design of office buildings.

Fire Loads

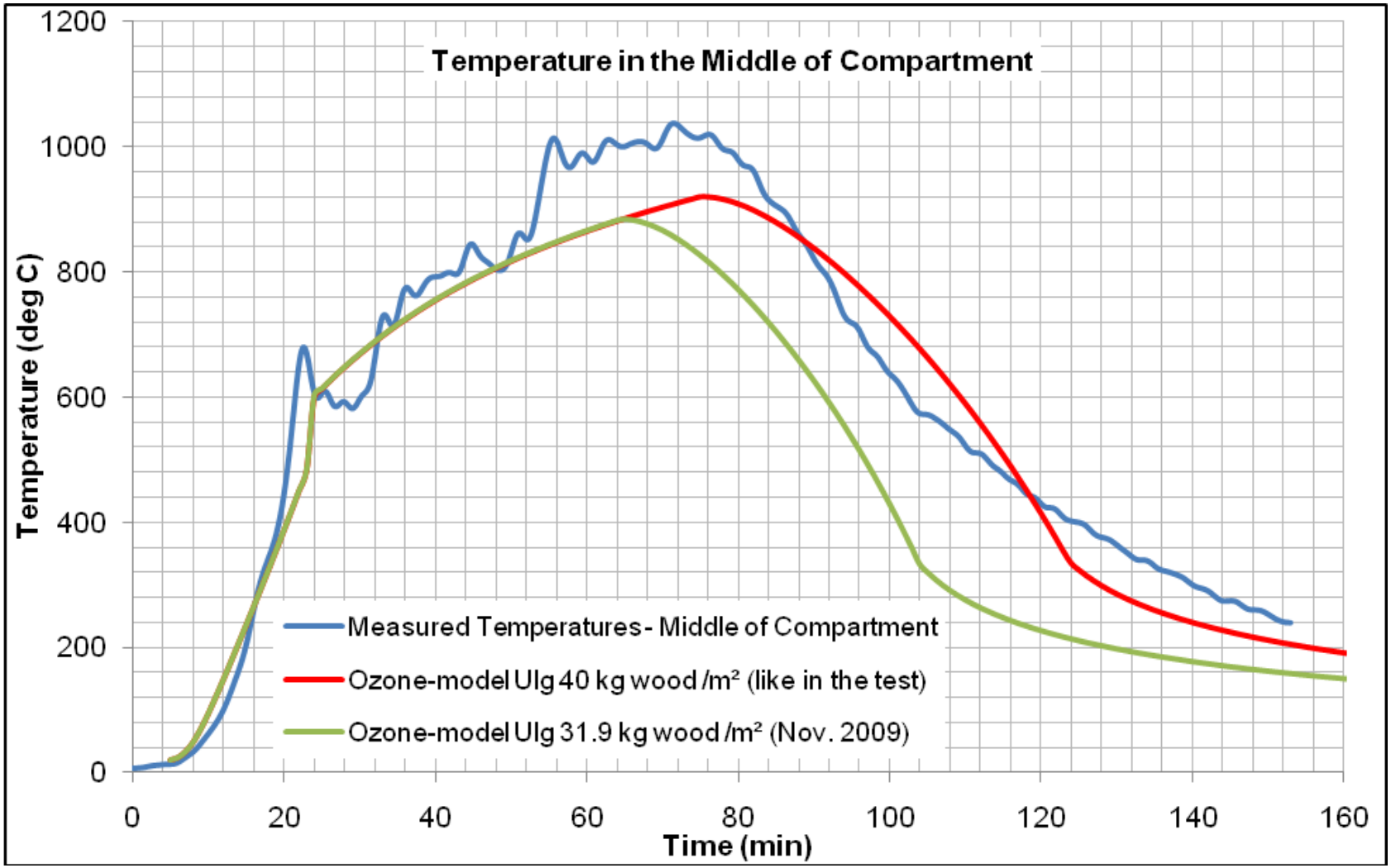


Assuming the design for an office, the fire load density would be 511 MJ/m^2 according to Table E.2 of EN 1991-1-2.

For the test, a fire load of 40 kg of wood/m^2 was used, which corresponds finally to a fire load of about 700 MJ/m².

Fire Loads

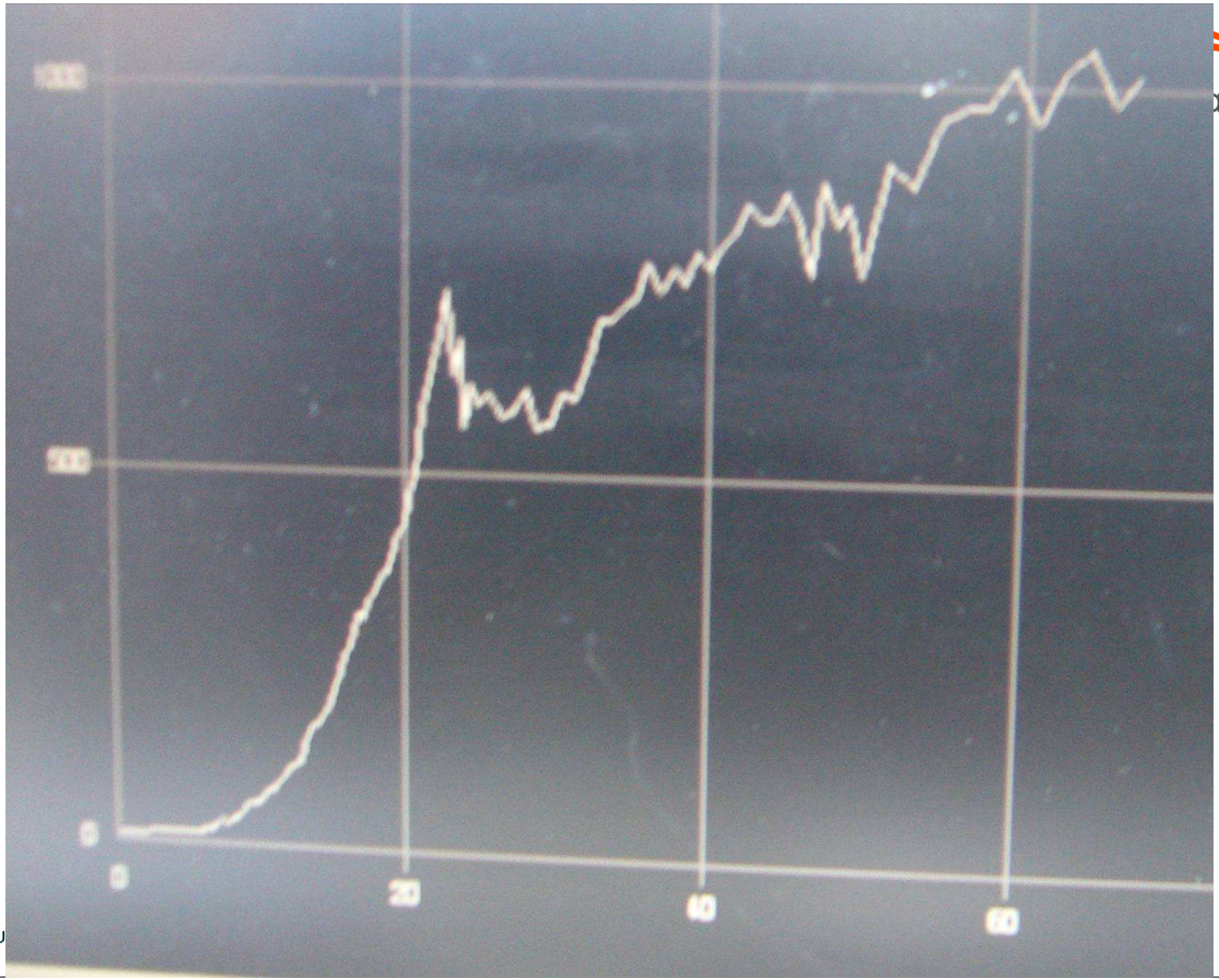
Temperature in the compartment




00:00


05:00


20:00


0
20
40
60


00:31:24


00:42:47

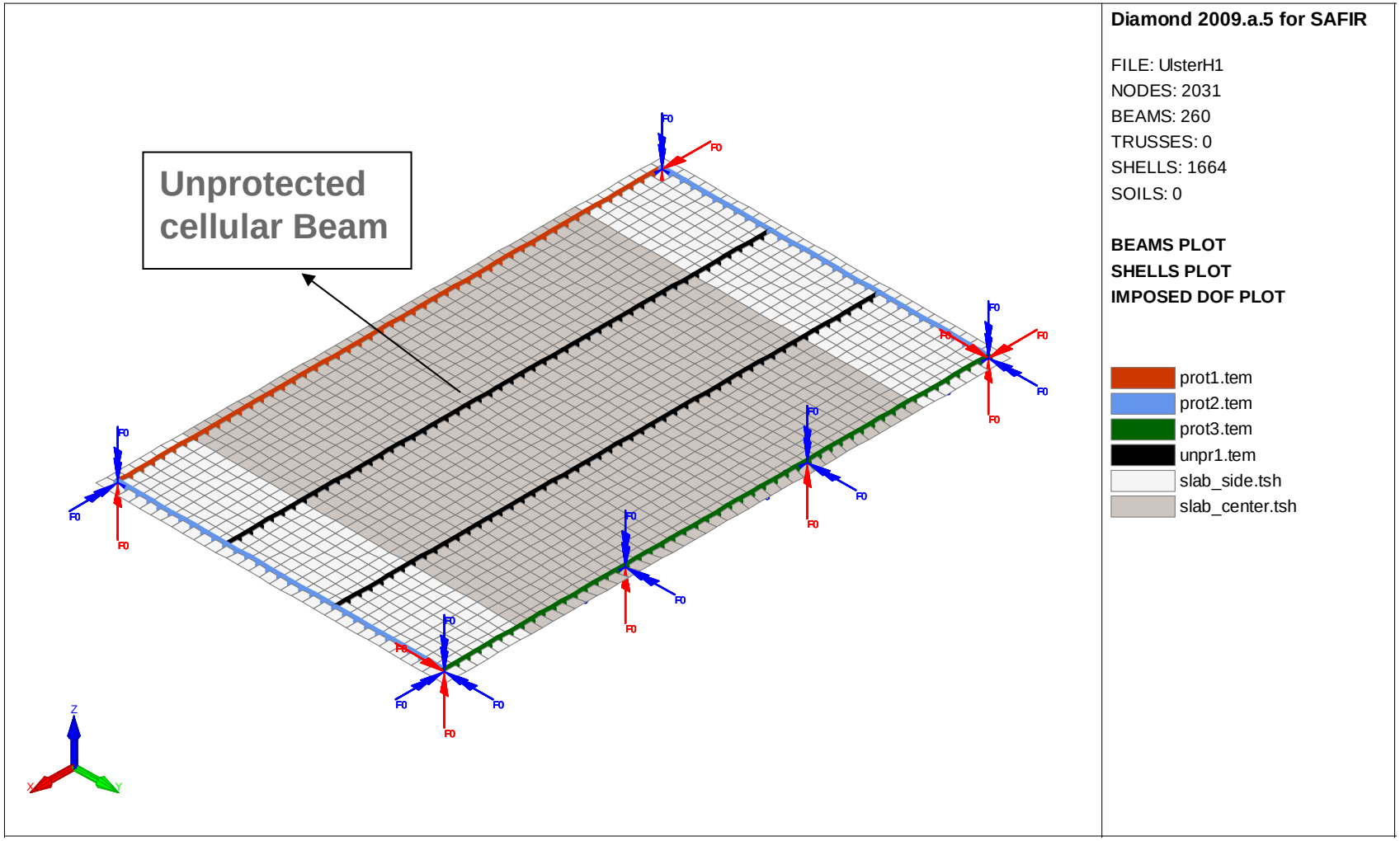

00:56:07


01:21:28

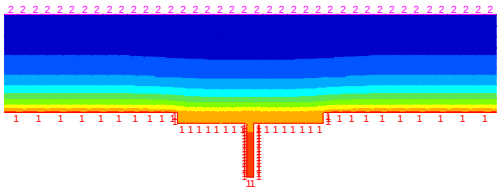
Shape of the beam after the fire

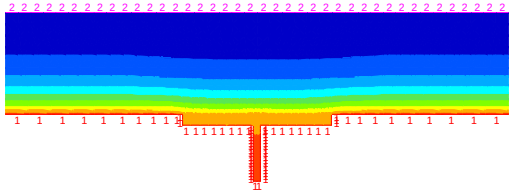
Shape of the beam and connection

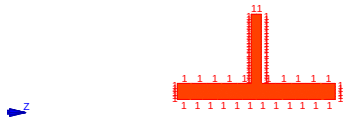
Safir Finite element prediction (made before the test)



Thermal Modelling







double tee section

upper tee section

FEM Stresses

SAFIR Results Vs Test Results